



Review Article

Global trends of research on advancing the pedagogical competence of preschool teachers: A bibliometric analysis

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ABSTRACT

The pedagogical competency of preschool teachers is critical in shaping the learning path of young learners in today's world. Modern early childhood education, by focusing on the development of crucial skills like teamwork, innovation, and problem-solving, lays the foundation for long-term learning and success. This research delved into the shift in global research outputs over time, spotlighted significant contributors including publications, authors, and countries, and surveyed the prevalent themes discussed. From 1993 to 2023, 1163 out of 2034 papers from the Scopus database were analysed. A quantitative bibliometric approach was utilized, rooted in the 7C-21 framework, using with the PRISMA model to assure a structured and exhaustive review process. The findings indicated a rising emphasis on promoting pedagogical competency in early-grade teaching force, as seen through increased scholarly contributions. Principal contributors, such as journals, authors, and countries, play a pivotal role in encouraging collaboration and the spread of knowledge. The research underscored the necessity for holistic training programs for 21st-century preschool teachers, spotlighting themes like early childhood educator training and the cultivation of pedagogical competence. The study also documented a transition towards practices driven by evidence and cutting-edge methodologies to meet the ever-changing learning requirements of young learners.

1. Introduction

The matter of preschool teacher competence has been increasingly spotlighted in recent years due to its crucial part in molding the early educational encounters of youngsters (Johnson et al., 2018). The academic exploration of preschool teacher competence has seen a noticeable rise, characterized by an expanding body of both theoretical and factual research, highlighting its growing recognition in scholarly dialogues (Rattiyi et al., 2020). Interestingly, there's a marked increase in all-encompassing studies aimed at fleshing out various aspects of preschool teacher competence within the scope of teacher training programs (Roslin et al., 2023; Chen & Wang, 2022). These investigations, coupled with the influential works by Vygotsky (1978) and Piaget (1962), together contribute to the present understanding of preschool teacher competence and underscore the necessity of perpetual research in this arena.

Finland, renowned for its exceptional education system, places a strong emphasis on early childhood education, necessitating preschool teachers to attain master's degrees in early childhood pedagogy (OECD, 2019; Sahlberg, 2015). Similarly, Singapore provides diploma and

degree courses through the National Institute of Early Childhood Development, underscoring child development and curriculum design, coupled with government-funded professional growth (Ministry of Education Singapore, n. d.). New Zealand prioritizes culturally-sensitive education through initiatives like the Early Childhood Education Taskforce and the Strengthening Early Learning Opportunities (Ministry of Education New Zealand, 2023). Sweden requires preschool educators to hold bachelor's degrees, with focus on child development and pedagogy and provisions for professional advancement through collaborative initiatives (SNAE, n. d.). These varied strategies highlight the role of preschool teacher proficiency. Although research emphasizes this significance, there arises a necessity for thorough reviews of contemporary literature to plug the existing gaps (Garcia, 2022; Johnson & Lee, 2019; Jones & Smith, 2020; Wang, 2021; Wang et al., 2021b).

Basing on the above experiences from various countries, it's crucial to investigate global research directions centered around enhancing the proficiency of preschool teachers. To this end, a bibliometric analysis was conducted to review global research efforts aimed at augmenting pedagogical skills among prospective preschool teachers in higher education. The aim was to provide beneficial insights for countries looking

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to fortify their early childhood education frameworks (Smith et al., 2018). This review helps identify global patterns and knowledge gaps, enabling countries to strategically channel their research and developmental endeavors (Jones & Johnson, 2019). It underscores evidence-supported practices from impactful studies to promote teacher proficiency and quality of early childhood education (Brown and Miller, 2020). Furthermore, it advocates for international research partnerships to nurture networks and exchange of knowledge (García-Martínez et al., 2018), informs evidence-based policy-making by investigating the impacts of policy on teacher advancement (Hansen et al., 2021), and ensures the alignment of initiatives with local values by acknowledging cultural and contextual nuances (Chen & Lee, 2017).

To bridge the identified gaps in the current literature, the researcher concludes that a bibliometric analysis is essential in providing key guidance for the enhancement of preschool teachers' skills and elevating the standard of early childhood education, all the while concentrating on three central research questions.

1. How have scholarly outputs on preschool teacher competence changed over time in teacher education programs?
2. Who are the main stakeholders, including journals, authors, countries, and key documents, contributed for the field of preschool teacher competence in teacher education programs?
3. What are the common themes and trends in discussions about preschool teacher competence in teacher education programs?

2. Theoretical framework

Pedagogical competence is the skill and expertise of teachers to effectively support learning through research-based teaching practices (Darling-Hammond, 2006). It includes knowledge, skills, and attitudes in crucial areas such as curriculum development, lesson planning, classroom management, student engagement, and assessment (Grossman, 1990; Shulman, 1987). In today's early childhood education, preschool teachers need strong pedagogical competence to meet the changing needs of young learners (Jalongo et al., 2021). Preschool classrooms now have diverse students who require personalized support to build essential skills for future success (NAEYC, 2020). Additionally, technology integration and the focus on 21st century skills like collaboration and problem-solving have increased the demands on early educators (Herrington & Bower, 2021; Voogt et al., 2021). Therefore, teacher training programs must enhance pre-service teachers' pedagogical competence through theory and practice to prepare the next generation of preschool professionals.

The theoretical foundation of this study delves into the Seven Competencies of Teachers the 21st Century (Model 7C-21) (Model 7C-21), which is found to be relevant framework associated with the development of pedagogical competence among pre-school teachers. The Model 7C-21 is a framework that delineates seven core competencies necessary for 21st century teaching: logical-mathematical thinking, verbal reasoning, elementary scientific culture, critical reading-writing, global culture and environment, metacognitive thinking, and vocational guidance orientation (Voogt & Roblin, 2012; Fraguela Collar & Rosas Colín, 2021). Voogt and Roblin (2012) developed this model to address shortcomings in traditional models in preparing educators for modern demands. The seven competencies focus on skills like problem-solving and intercultural understanding to foster 21st century skills in students.

Each of the seven competencies is described in-depth. Logical-mathematical thinking involves numeracy, patterns, and problem-solving skills crucial for early math development (Casey et al., 2013). Verbal reasoning covers oral and written proficiency, emphasizing language development methods (Bowyer-Crane et al., 2008). Elementary scientific culture promotes discovery-based learning through hands-on experimentation and nature observation (Patrick & French, 2008). The model emphasizes integrating these competencies through diverse field experiences and curriculum integration (Williams & Hierck, 2021). The

rationale for selecting the 7C-21 framework is that it provides guidance for preschool teacher training programs to comprehensively enhance pedagogical competence. It also outlines the synergistic application of competencies in varied educational contexts. Therefore, the researcher opted for this model as it equips teachers for modern classrooms through developmentally-informed, play-based pedagogies.

The theoretical model utilized in this study, the 7C-21 model, has offered significant understanding into the competencies of preschool teachers. Nevertheless, we must recognize any potential biases and restrictions within this model to facilitate a detailed and balanced discussion. Experts have recently emphasized that theoretical structures should be critically assessed to understand their contextual restrictions and possible biases (Smith et al., 2022). Acknowledging these limitations may enhance future research into the applicability and validity of the 7C-21 model across various learning environments. For example, empirical studies that verify the model's effectiveness in different cultural and socioeconomic settings would contribute to its wider acceptability (Jones & Brown, 2023). Moreover, examining alternative theoretical approaches or amalgamating multiple models can help in addressing biases while providing a more thorough grasp of preschool teachers' competence (Garcia, 2023). In doing so, future studies can reinforce the theoretical underpinnings of the 7C-21 model, furthering its application in preschool teacher training initiatives.

3. Methods and materials

This quantitative research study aimed to enhance preschool teacher education by exploring and analyzing the field. The study utilized the Scopus database as a guide for its design, praised for its broad coverage and academic integrity (Tamela, 2020; Erfanmanesh et al., 2017). A custom search string, as indicated in Table 1, was carefully crafted to sift through titles, abstracts, and keywords, capturing scholarly contributions from 1993 to 2023. Keywords aligned with the study's theoretical framework, Model 7C-21, were used, including pre-school teacher education, early childhood teacher education, initial teacher education, development, pedagogical competence, and practicum. This journey through time, conducted in English, resonated with numerous journals each contributing to the academic conversation.

According to Table 2, a total of 1163 English-language peer-reviewed articles were analyzed using the PRISMA methodology for systematic document collection and selection. As it was shown in Fig. 1, this method ensured transparency, this method ensured transparency and quality in selecting high-caliber articles through various stages such as eligibility criteria, title and abstract screening, full-text assessment, and final dataset compilation.

In essence, the review piece, although mainly focused on bibliometric analysis, effectively offers a snapshot of the changing landscape of research geared towards enhancing the pedagogical skills of preschool educators, throwing light on potential future pathways in this field. However, one must bear in mind that this study doesn't comprehensively tackle the subject matter. The data examination was

Table 1
Search strategy.

Type	Criteria
Database	Scopus
Search string	TITLE-ABS-KEY ("Pre-school teacher education" OR "early childhood teacher education" OR "initial teacher education" AND "development" OR "pedagogical competence" OR "practicum")
Time Span	1993–2023
Subject area	All
Document type	Article
Source of the publications	Journals
Language	English
Search date	June 6, 2023

Table 2
Main information.

Description	Results
Timespan	1993–2023
Sources (Journals)	304
Articles	1163
Average citations per document	14.75
Keywords plus	222
Author's keywords	2214
Authors	2200
Authors of single-authored documents	346
Authors of multi-authored documents	817
Single-authored documents	381
Documents per author	1.89
Authors per document	0.53
Co-authors per document	2.25
International Co-authorship (%)	9.974

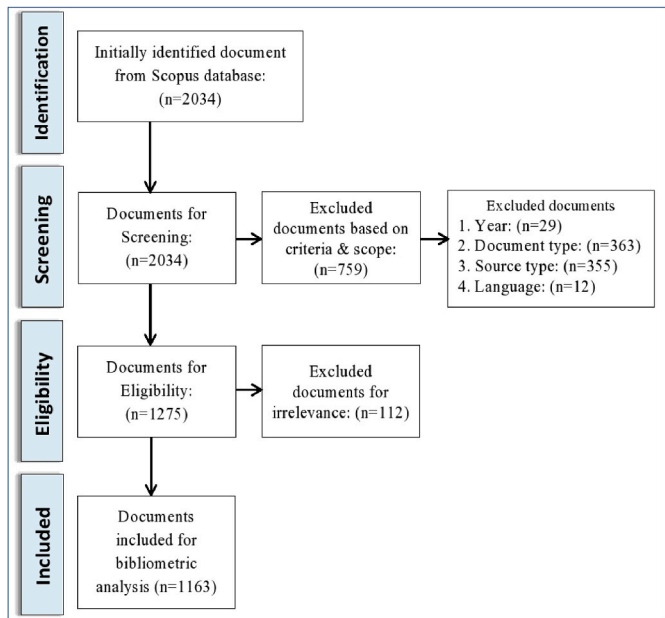


Fig. 1. The PRISMA model.

performed using well-regarded tools, Biblioshiny and R-Studio, with all bibliographical info passed onto Biblioshiny to carry out a descriptive analysis. After which, the tables and figures were migrated to Microsoft Word for better organization.

The core of the analysis assessed several elements like publication metrics, the impact of authors, the influence of specific journals and countries, critical keywords, trending topics, and interconnected networks. All these data were synthesized with the objective to comprehend the evolution of preschool teacher competence over time. By scrutinizing a research period spanning three decades, the study aims to augment understanding and pinpoint areas that future research might explore, particularly focusing on pedagogical competence development among preschool educators enrolled in teacher training programs.

4. Results and discussions

4.1. Results

The bibliometric analysis results are presented here based on the three research questions.

1 How have scholarly outputs on preschool teacher competence changed over time in teacher education programs?

Over the span of three decades, spanning from 1993 to 2023, a meticulous examination of the extant body of literature pertaining to pre-school teacher education research reveals a multifaceted landscape (Table 2). This comprehensive compilation encompasses a total of 1163 articles culled from 304 distinct scholarly journal sources. The significance of this corpus of research is underscored by the remarkable average of 14.75 citations per article, a testament to its substantial influence within the purview of this academic discipline. Notably, the dataset exhibits a rich tapestry of linguistic diversity, manifest in the discernment of 222 standard keywords and 2214 author-defined keywords.

The collaborative underpinning of this research endeavor emerges prominently, with approximately 2200 discrete authors contributing to this collective scholarly enterprise. Among this cohort, 346 authors have authored individual papers, while 817 authors have actively engaged in collaborative ventures resulting in multi-authored publications. The preponderance of multi-authored documents, constituting the majority, underscores a prevailing trend of cooperation both in the conduct and dissemination of research in the domain of pre-school teacher education. On average, each scholarly work boasts 2.25 co-authors, further accentuating this collaborative ethos. The unity of purpose is further exemplified by each author's contribution, averaging at 1.89 documents, and each document being the product of roughly 0.53 authors.

The international perspective is conspicuously evident, with nearly 10% of the articles featuring co-authors hailing from diverse countries, indicative of a global reach and the cross-pollination of ideas in this domain.

According to Fig. 2, the data portrays the annual scholarly output in the field of pre-school teacher education over a span of three decades, commencing from 1993 and culminating in 2023. Noteworthy findings encompass a zenith in article publications in the year 2022, amassing a total of 97 articles. An overarching trend of increased production in recent years is evident, with annual counts surpassing 70 from 2016 to 2021. In stark contrast, the early to mid-1990s registered the nadir of production, notably plummeting to a mere 5 articles in 1994. It is of significance that the production consistently began its ascent from the late 1990s onwards. More notably, during the last decade, specifically in the years 2022, 2019, and 2020, there was a notable surge in output, ranging between 86 and 97 articles each year. This comprehensive dataset, spanning the duration of 30 years, underscores a remarkable surge in scholarly output, indicative of the mounting scholarly interest and the expanding body of work in the realm of pre-school teacher education throughout this time frame.

Fig. 3 provides a succinct analysis of the landscape of preschool teacher education, with a focus on key scholarly sources and their corresponding publication frequencies. Notably, the preeminent contributor in this domain is the Journal of Education for Teaching, boasting a substantial 79 articles, closely trailed by Teaching and Teacher Education, with a commendable count of 69 articles. Furthermore, noteworthy sources include the Australian Journal of Teacher Education, which has made a significant contribution with 48 articles, followed closely by the European Journal of Teacher Education, boasting 47 articles. The Journal of Early Childhood Teacher Education also merits attention, having produced 44 articles of significance.

This compilation of scholarly sources underscores the conspicuous influence and quantitative contributions of specific academic journals to the broader discourse within the preschool teacher education field. It serves as a testament to the scholarly prominence of these journals, accentuating their pivotal role in shaping the literature of this academic domain. Furthermore, this ranking of journals underscores the predominant focus on educational aspects in the realm of research conducted within this particular academic arena.

2. Who are the main stakeholders, including journals, authors, countries, and key documents, in the field of preschool teacher competence in teacher education programs?

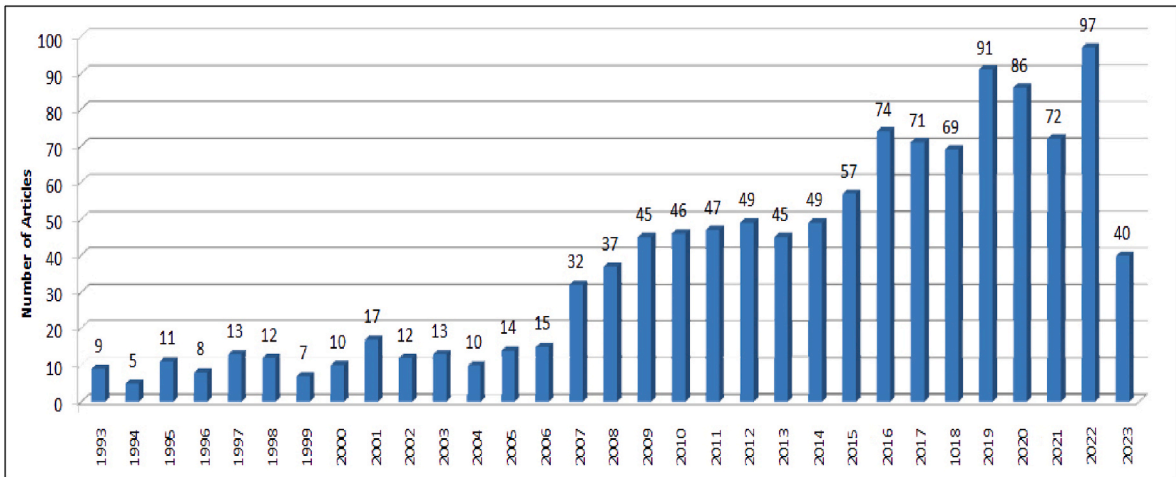


Fig. 2. Annual production of publications from 1993 to 2023.

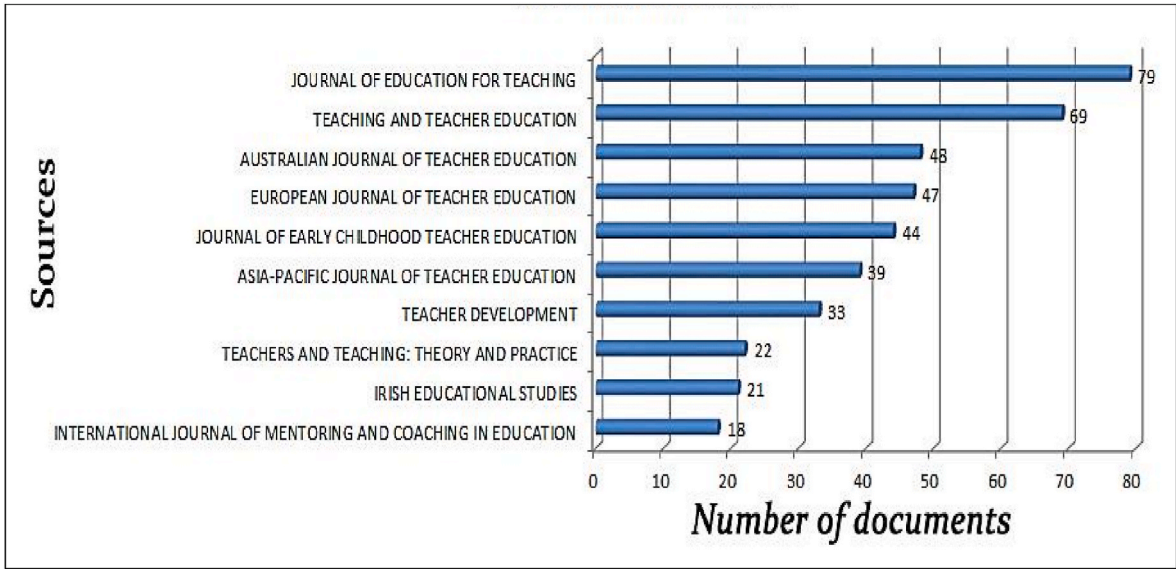


Fig. 3. The most relevant sources in terms of number of publications.

4.2. Contribution of journals in terms of productivity and impact

In the realm of education and teacher preparation as indicated in Table 3, numerous academic journals have made substantial contributions, each demonstrating varying degrees of scholarly influence. Amongst these periodicals, the preeminent position is held by the

Table 3
Source impact.

Element	H_Index	TC	NP	PY_Start
Teaching and Teacher Education	27	2656	69	1998
Journal of Education for Teaching	23	1548	79	1993
European Journal of Teacher Education	18	1061	47	1995
Asia-Pacific Journal of Teacher Education	17	906	39	2007
Teachers and Teaching: Theory and Practice	13	630	22	1998
Australian Journal of Teacher Education	14	603	48	2008
Educational Review	4	406	9	1994
Journal of Teacher Education	4	389	5	2009
Teacher Development	12	381	33	1997
Journal of Early Childhood Teacher Education	9	306	44	1993

TC, total citation; NP, number of publications; PY, publication year.

esteemed “Teaching and Teacher Education” journal, distinguished by its exceptional source impact. Boasting an impressive h-index of 27, it outpaces its counterparts in both productivity and scholarly influence, signifying a consistent history of publishing influential research articles over an extended period. Notably, the “Teaching and Teacher Education” journal also commands the highest aggregate citation count within the field, standing at an impressive tally of 2656. This attests to the wide-reaching references garnered by the research disseminated within its pages, affirming its substantial impact on the academic discourse. Moreover, since its inception in 1998, the journal has amassed a prolific 69 publications, underscoring its unwavering commitment to the production of scholarly work.

The “Journal of Education for Teaching” similarly evinces a potent source impact, underscored by an h-index of 23 and a total citation count of 1548. This periodical, in publication since 1993, has yielded 79 publications, thereby establishing a substantial body of academic inquiry. Additional journals, such as the “European Journal of Teacher Education,” The “Asia-Pacific Journal of Teacher Education,” and The “Australian Journal of Teacher Education,” have each made noteworthy contributions to the field. While their h-indices and cumulative citation counts marginally trail the foremost journals, they have nonetheless

delivered a commendable volume of research output, ranging from 39 to 48 publications.

In contrast, journals such as the “Educational Review,” “Journal of Teacher Education,” “Teacher Development,” and “Journal of Early Childhood Teacher Education” exhibit relatively lower h-index values and total citation counts. Nevertheless, they have made valuable contributions to the field, each with their own unique focus areas and research outputs.

The presented data in Fig. 4 reveals a comprehensive longitudinal examination of publication trends encompassing the period from 1993 to 2023, encompassing the scholarly output of five prominent journals in the field of early childhood teacher education. Noteworthy among these journals is the Journal of Education for Teaching, which has demonstrated unwavering prolificacy by consistently maintaining an annual publication rate of no less than ten scholarly articles since 1999. This pinnacle was reached in 2023, with an impressive total of 79 publications.

The Teaching and Teacher Education journal has consistently secured the second-highest position in terms of scholarly output, consistently shadowing the Journal of Education for Teaching in recent years. Meanwhile, both the European Journal of Teacher Education and the Journal of Early Childhood Teacher Education have displayed a gradual upward trajectory in their scholarly productivity, culminating in peak outputs during the late 2010s and early 2020s. It is pertinent to acknowledge the developmental trajectory of the Australian Journal of Teacher Education, which initially experienced a dearth of publications until the late 1990s or early 2000s. However, it has since made commendable strides in augmenting its annual scholarly production. Despite this commendable progress, it continues to occupy a subordinate position in comparison to the aforementioned journals.

Even when narrowing the gaze to the past 5 years, the data reveals intriguing trends among the publishing sources during this period. The Journal of Education for Teaching consistently maintained the leading position in terms of the quantity of articles it published annually, with Teaching and Teacher Education coming in second place. The publication numbers for the Australian Journal of Teacher Education and the European Journal of Teacher Education displayed considerable similarity, while the Journal of Early Childhood Teacher Education consistently ranked last in terms of the number of articles it published among

the mentioned journals. When analyzing patterns, there’s an overall incline in the number of articles all the journals published, indicating a spark of increasing interest and emphasis on boosting the pedagogical skills of pre-school educators within scholarly circles. The most substantial surge in publications is observable from 2018 to 2019, marked by a significant increase in the number of articles that all journals released.

4.3. Contribution of authors in terms of productivity and impact

Table 4s data provides a clear picture of the academic productivity and influence of leading authors in preschool teacher education. Although bibliometric gauges like the h-index and citation counts provide a quantitative perspective, interpreting them with care to nuances is essential. Most authors have a modest h-index of 1, mirroring the early-research phase of many in this emerging field. Still, a few authors with higher h-indices are noteworthy, indicating prolonged and significant influence. Florian L, for instance, has an h-index of 3, acquired through consistent high-quality contributions since 2009, amassing over 300 citations and signaling lasting academic influence.

Authors like Kleickmann T, Kunter M, and Richter D, with h-indices of 2, suggest moderate influential trajectories, potentially due to constant publication records and involvement in significant collaborations. Authors like Hong JY, Krauss S, Hornby G, and Lafele R, with h-indices of 1, have also made important contributions, as their citation counts, exceeding 350 in some instances, indicate. Additionally, authors can gain visibility through widespread distribution of their work than solely through publication quantity. For instance, Tan SYF, with the highest h-index of 8 and over 200 citations across 12 publications over two decades, demonstrates notable readership and acceptance of their views.

These markers should be understood contextually, considering individual career-influencing aspects like research support, collaborative networks, and publishing practices within varying national research landscapes and institutional contexts over time. Continual analysis can deliver profound understanding into global trends influencing early career development and academic impact.

Examining the Table 5’s Most Cited Countries dataset reveals significant trends in the field of pre-school teacher education research. Leading the pack is the United Kingdom, drawing attention with an

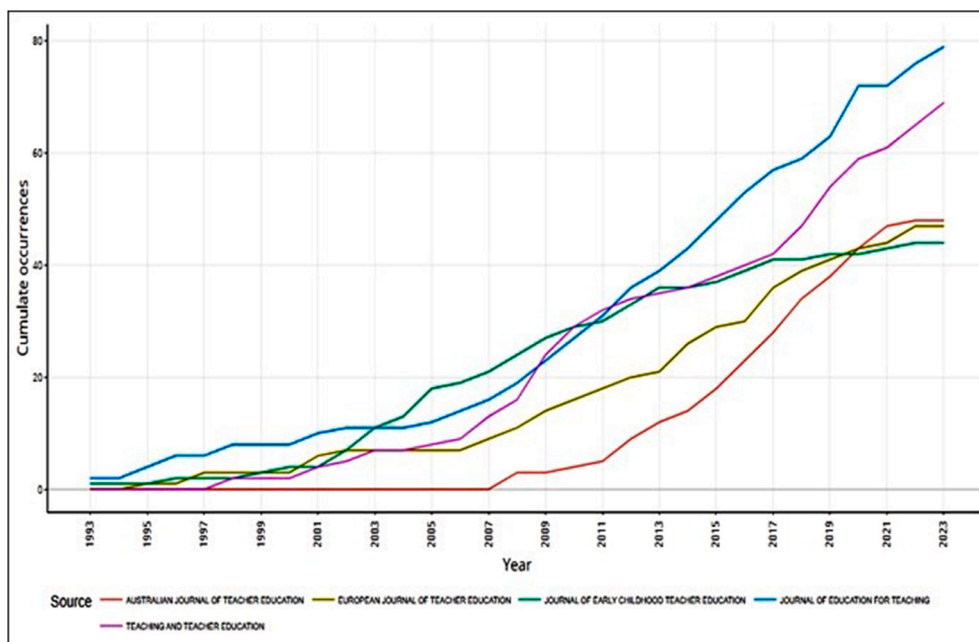


Fig. 4. Source growth over time.

Table 4
Authors' productivity and impact.

Element	h_index	TC	NP	PY_start	Element	h_index	TC	NP	PY_start
Hong JY	1	408	1	2010	Krauss S	1	278	1	2013
Hornby G	1	364	1	2011	Burn K	5	254	5	2003
Lafaele R	1	364	1	2011	Caena F	3	251	3	2014
Florian L	3	332	3	2009	Mutton T	4	250	4	2003
Kleickmann T	2	291	3	2013	Tang SYF	8	236	12	2003
Kunter M	2	289	3	2013	Allen JM	5	236	5	2011
Richter D	2	280	2	2013	Munthe E	3	233	3	2011
Baumert J	1	278	1	2013	Sinclair C	1	204	1	2008
Besser M	1	278	1	2013	Instefjord EJ	1	193	1	2017
Elsner J	1	278	1	2013	Flores MA	5	186	6	2001

TC, total citations; NP, number of publications; PY, publication year.

Table 5
Countries producing the highest impact in terms of total citations and average article citations (2 files).

Country	Total citations	Country	Average article citations
UNITED KINGDOM	3656	CYPRUS	84
AUSTRALIA	1961	GREECE	56.5
USA	1762	BELGIUM	39.5
NEW ZEALAND	889	NORWAY	35.6
IRELAND	781	GERMANY	33.6
NORWAY	676	ISRAEL	32.4
GERMANY	604	KAZAKHSTAN	29
CANADA	542	SLOVENIA	28.3
HONG KONG	500	ZIMBABWE	25
TURKEY	408	CHINA	24.3

impressive 3656 citations, solidifying its position alongside Australia (1961) and the USA (1762). These countries collectively contribute over fifty percent of the total citations, underscoring their substantial influence. Notable mentions go to New Zealand, Ireland, Norway, and Germany, with citation counts ranging from 604 to 889, establishing their prominent status. When considering average article citations, Cyprus (84), Greece (56.5), and Belgium (39.5) stand out as frontrunners, showcasing the substantial impact of their research outputs. Equally noteworthy are Norway, Germany, Israel, and Kazakhstan, maintaining averages exceeding 30, a testament to their consistent and impactful contributions. Zimbabwe, China, and Slovenia also perform commendably relative to their research volume, with average citations ranging from 25 to 28.3. Despite the inclusion of non-Western nations in the dataset, traditional English-speaking and Western European countries unquestionably dominate. These specific nations have solidified their global leadership through significant and influential research efforts, advancing our understanding of pre-school teacher education practices and concerns.

The dataset brings into focus the nations commanding the highest impact in terms of total article citations. Australia closely follows with 1961 citations, reaffirming its substantial contributions to scholarly literature. The United States, New Zealand, and Ireland also feature prominently, with commendable citation counts that underscore their significant presence in academic research. Additionally, the dataset reveals the nations wielding the highest impact in terms of average article citations. Cyprus stands out with an impressive average of 84 citations per article, indicative of the profound impact of research originating from this region. Greece and Belgium similarly display elevated average article citations, suggesting a tendency for scholarly articles from these areas to garner a higher number of citations on average. Noteworthy mentions go to Norway, Germany, and Israel, exhibiting commendable average article citations, thus highlighting their discernible contributions to the academic literature landscape.

It is crucial to emphasize that while total article citations provide a comprehensive view of a country's overall research impact, average article citations offer insights into the impact per individual article. In

summary, the United Kingdom, Australia, and the United States stand as leaders in total article citations, while Cyprus, Greece, and Belgium claim preeminence in the realm of average article citations. These nations have made a lasting impact through substantial contributions to academic research, earning recognition for their scholarly achievements across diverse fields.

4.4. Contribution of documents in terms of impact

According to Table 6, The assessment illuminates pivotal works shaping the field, based on collective citations. The 2010 publication by Hong JY stands out with over 400 citations, translating to an impressive average annual citation rate of 29. Evidently, this seminal study has resonated within the research community, paving the way for further exploration of its key concepts. Other highly cited works such as Hornby G's 2011; Kleickmann T's 2013 publications continue to have lasting impacts, maintaining their strong yearly citation velocities even ten years post-publication. This reflects their relevance and enduring influence over subsequently catered research agendas.

More recent publications too feature among the most-cited, indicating evolving consensus. Contributions by Instefjord EJ in 2017 and Caena F in 2019 maintain robust annual citation rates, suggesting they address topics that continue to reverberate within early career trajectories. Florian L's name appears multiple times, emphasizing consistent high-grade contributions, especially through distinct 2009 and 2010 publications. Gudmundsdottir GB's 2018 study is notable for its exceptional normalized citation count, suggesting swift assimilation into the field. The repeating influence of authors such as Hong JY, Hornby G, Kleickmann T, and Florian L indicates research leaders who have made lasting contributions through innovative conceptual structures or methodologies.

Although these citation-rich works tackle various substantial topics, their collective impact underscores the dynamic and multi-disciplinary nature of the field. Their abiding influence underlines the necessity for continuous critical reviews and updates of conceptual foundations to maintain advancement. On-going citation pattern analysis may expose evolving consensus areas worthy of deeper exploration.

4.5. Countries collaboration network

The most frequent collaboration as indicated in Fig. 5 is observed between the UK and Australia, with six jointly authored articles indicating a deep-seated and enduring connection. Other significant collaborations are seen in five joint publications each between Australia-Canada and Australia-New Zealand, highlighting intimate knowledge sharing among these English-speaking nations. Likewise, regional collaborations within Europe and Nordic nations suggest robust formal and informal structures supporting collaborative endeavors. Although collaborations likely involve collective study designs, methodological expertise sharing, and joint findings interpretation, it's difficult to decipher each collaborator's specific contributions without substantial

Table 6
Top ten most globally cited documents.

Author	Year	Title	Total Citations	TC per Year	Normalized TC
Hong JY.	2010	Pre-service and beginning teachers' professional identity and its relation to dropping out of the profession	408	29.14	11.74
Hornby G.	2011	Barriers to parental involvement in education: an explanatory model	364	28	11.74
Kleickmann T.	2013	Teachers' Content Knowledge and Pedagogical Content Knowledge: The Role of Structural Differences in Teacher Education	278	25.27	13.21
Sinclair C.	2008	Initial and changing student teacher motivation and commitment to teaching	204	12.75	8.62
Instefjord EJ.	2017	Educating digitally competent teachers: A study of integration of professional digital competence in teacher education	193	27.57	12.77
Florian L.	2010	Preparing teachers for inclusive education: using inclusive pedagogy to enhance teaching and learning for all	184	13.14	5.29
Gudmundsdottir GB.	2018	Newly qualified teachers' professional digital competence: implications for teacher education	182	30.33	13.36
Caena F.	2019	Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for	161	32.2	15.47

Table 6 (continued)

Author	Year	Title	Total Citations	TC per Year	Normalized TC
Deluca C.	2010	Educators (<i>Digcompedu</i>) Assessment literacy development: identifying gaps in teacher candidates' learning	155	11.07	4.46
Florian L.	2009	The inclusive practice project in Scotland: Teacher education for inclusive education	143	9.53	5.29

TC: total citations; PY: publication year.

publication details. In-depth author bibliometrics and linked datasets review could offer insights into the depth and duration of collaborative partnerships.

Some collaborations extend broad geographical distances, for instance, between the UK-US and Australia-US, demonstrating the ability to forge partnerships across extensive geographical gaps likely through digital platforms, exchange programs, or scholarly conferences to initiate and maintain collaborative projects. International partnerships, however, pose challenges like dissimilarities in funding availability, diverging national agenda priorities, language barriers, and logistical complications co-ordinating multi-sited studies which may diminish efficacy if left unaddressed. The provision of policy supports like travel grants and open-access publishing would help tackle these issues.

On the whole, this broad collaboration network examination sets the stage for more insightful qualitative studies delving into the practices, infrastructure, and results of international collaborations to enhance global early childhood research capacities in the long run. Addressing challenges can amplify their effect on worldwide theory, policy, and practice.

4.6. Most frequently discussed themes

3 What are the common themes and trends in discussions about pre-school teacher competence in teacher education programs?

The co-occurrence network analysis as shown in Fig. 6 undertakes a comprehensive examination of the scholarly landscape within the domain of preschool teacher education literature. This analysis casts a discerning light upon frequently co-occurring terms, thus illuminating the intricate web of interrelations that characterizes this field of educational research.

Within the realm of educational inquiry, the strategic application of cluster analysis stands as a proven and invaluable methodology. It serves to unveil discrete thematic clusters that, in turn, yield profound insights into the multifaceted tapestry of teacher education and development. The initial cluster, encompassing a rich amalgamation of keywords such as initial teacher education, professional development, mentoring, pedagogy, and inclusive education, presents a panoramic view of the multifarious facets that constitute teacher education. This cluster, through its intricate composition, offers a nuanced portrayal of this expansive field.

Cluster 2 directs our attention to the central node of “student teacher,” accentuating its paramount significance within the network. In contrast, Cluster 3 adopts a more focused lens, zeroing in on the critical

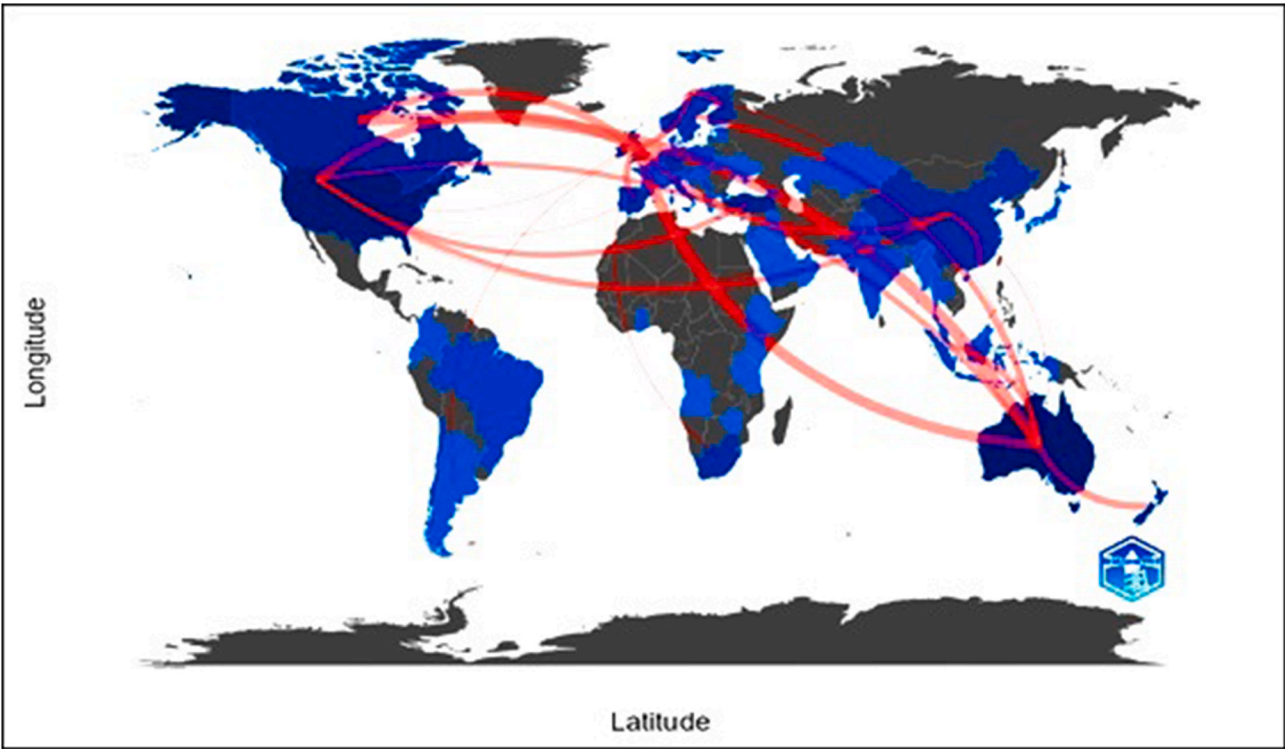


Fig. 5. The World Map of Countries' Collaboration Network.

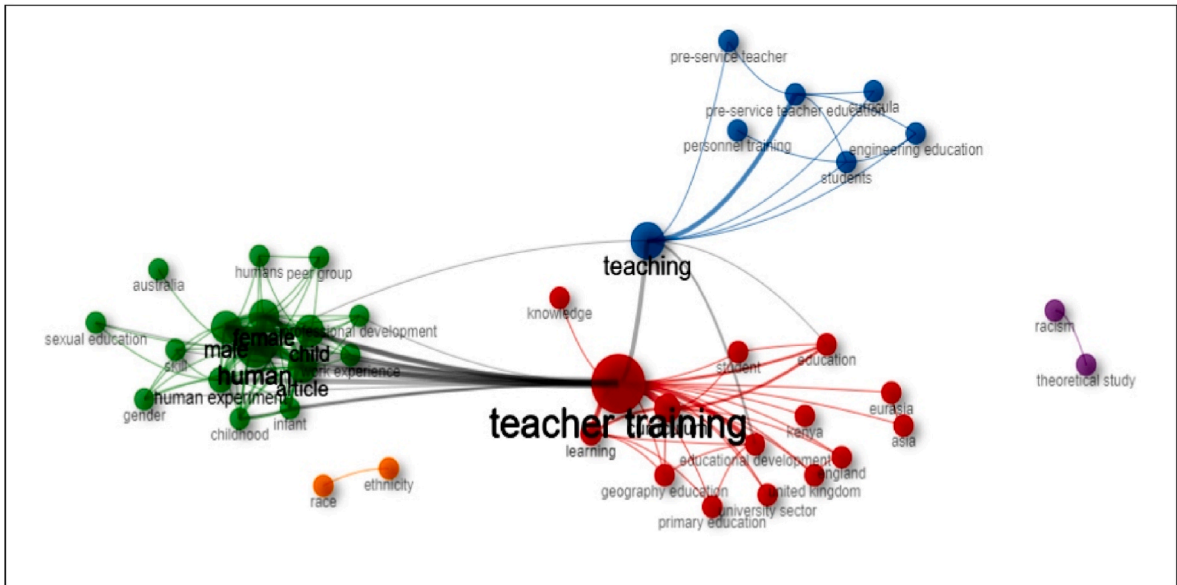


Fig. 6. Co-occurrence network for keywords.

domain of “early childhood education.” Cluster 4 elegantly merges the nodes of “literacy” and “creativity,” symbolizing their interconnected roles within the educational landscape. Finally, Cluster 5 embarks on an exploration of the intertwined concepts of “teacher preparation” and “early childhood,” thus shedding light on their intricate interconnections.

The investigation extends to network metrics, notably the concept of betweenness centrality, which serves to identify nodes that play a pivotal role in facilitating network connectivity. This analysis underscores “initial teacher education” as the paramount connector, emphasizing its indispensable role in bridging diverse segments of the

network. Additional nodes, such as “pre-service teacher education” and “teacher education,” also exhibit noteworthy betweenness centrality, attesting to their contributions to network cohesion (see Fig. 5).

In the evaluation of closeness centrality, a measure of nodes’ efficiency in establishing connections with others, “initial teacher education” emerges as the most central node, reinforcing its pivotal position within the network. “Pre-service teacher education” and “teacher education” closely follow suit as significant players due to their proximity to other nodes. The application of PageRank, an algorithm that assesses nodes’ influence based on both the quality and quantity of their connections, assigns the highest value to “initial teacher education,”

thereby affirming its overarching significance in the network. “Pre-service teacher education” and “teacher education” similarly garner substantial PageRank values, further solidifying their influential roles (see Fig. 6).

4.7. Thematic evolution

The presented thematic map provides a visual representation of patterns, word associations, clustering, and centrality metrics spanning the period from 1993 to 2008. It effectively delineates discrete clusters that encapsulate various facets of teacher education and development. Notably, the initial two clusters, denoted as Cluster 1 and Cluster 2, respectively (Fig. 7), are centered on pre-service and initial teacher education. Their prominence is underscored by their frequent occurrences and high centrality measures, thus emphasizing their paramount significance in adequately equipping prospective educators. This underscores the critical importance of delivering comprehensive and rigorous training to individuals aspiring to enter the teaching profession (see Fig. 7).

The presented thematic map indicated in Fig. 7 provides a visual representation of patterns, word associations, clustering, and centrality metrics spanning the period from 1993 to 2008. It effectively delineates discrete clusters that encapsulate various facets of teacher education and development. Notably, the initial two clusters, denoted as Cluster 1 and Cluster 2, respectively, are centered on pre-service and initial teacher education. Their prominence is underscored by their frequent occurrences and high centrality measures, thus emphasizing their paramount significance in adequately equipping prospective educators. This underscores the critical importance of delivering comprehensive and rigorous training to individuals aspiring to enter the teaching profession.

Cluster 3, the third thematic grouping, accentuates the importance of continuous professional growth for educators. Within its domain are concepts such as practicum, action research, and student teachers, all of which highlight the perpetual need for educators to refine their pedagogical competences and expand their knowledge base. Clusters 4 through 11 encompass a diverse spectrum of themes, including teacher competence, early childhood teacher education, subject expertise, special educational needs, inclusive education, and novice teachers. These clusters exemplify distinct areas of emphasis and inquiry within the field of education, revealing the intricate and multifaceted dimensions of

teacher education while addressing the heterogeneous requirements of learners. The insights garnered have the potential to inform policy formulation, curriculum enhancements, and strategies aimed at elevating the standards of teacher education and improving the overall quality of education.

According to Fig. 8, the analysis of thematic cluster representations from 2009 to 2023 highlights noteworthy clusters with significant consequences for the educational environment. The most prominent of them is Cluster 2, which focuses its analysis on the field of pre-service teacher preparation. Terms like “pre-service teacher education,” “professional development,” and “initial teacher education” are frequently used, suggesting a strong desire to raise the standard of teacher education programs. Furthermore, the combination of important terms, such as; “practicum,” “mentoring,” and “inclusive education” signals a clear move toward experiential learning paradigms and inclusive pedagogy. This change is the culmination of a committed effort to provide educators with the necessary skills to effectively meet the various needs of their varied student body.

The investigation of instructional practice and pedagogical approaches has its focus in Cluster 9. The prominent appearance of lexicological components like; “lesson study,” “pedagogy,” and “curriculum” highlights a fervent dedication to the improvement of instructional techniques and curriculum frameworks. This ideological orientation denotes a focus on instructional strategies and the adoption of effective teaching practices. The addition of “lesson study” highlights even more the community of educators’ passion for cooperative professional development and the dissemination of best practices in instruction.

Nestled within Cluster 6 is a pointed emphasis on early childhood education, as substantiated by terminological facets such as “early childhood teacher education” and “field experience.” These descriptors accentuate the premium placed on practical field immersion experiences within the purview of early childhood pedagogy. This accentuation duly recognizes the unique exigencies and developmental facets inherent to early childhood education, thereby underscoring the import of hands-on learning opportunities for practitioners operating within this sphere. Concomitantly, Cluster 5 revolves around the theme of professional identity, as corroborated by the presence of keywords such as “professional identity,” “professional learning,” and “teacher identity.” This particular cluster signifies an intrinsic interest in the nurturing and

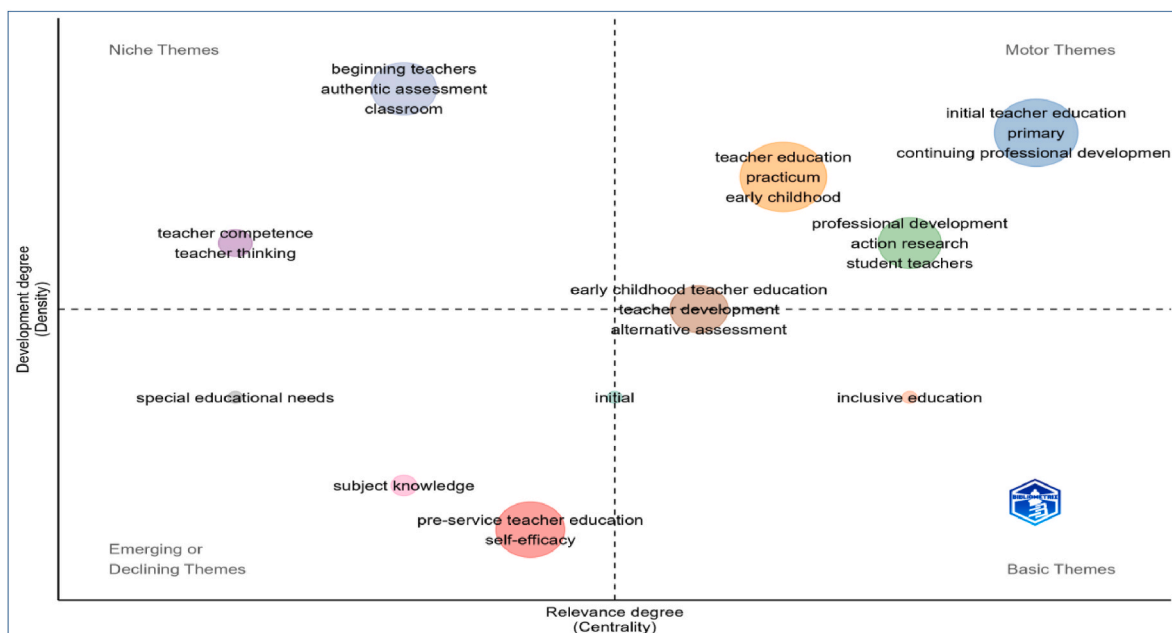


Fig. 7. Thematic diagram for the first 15 years (1993–2008).

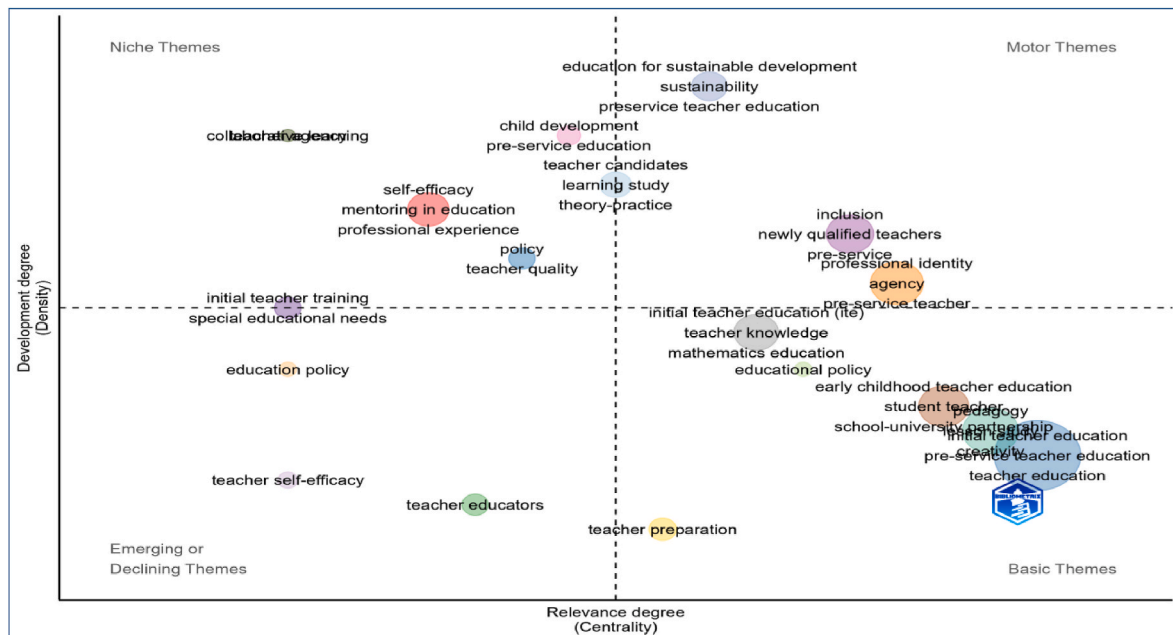


Fig. 8. Thematic diagram for the second 15 years (2009–2023).

elucidation of professional identities within the cadre of educators. It serves to underscore the significance attributed to sustained professional development initiatives and the cultivation of a robust professional identity.

These leading clusters are complemented by smaller but significant groups, such as Cluster 4 (inclusion), Cluster 8 (beginning teacher education and agency), and Cluster 1 (self-efficacy). These secondary clusters help to illuminate other areas of study and research in the field of education. In summary, the examination of thematic cartographic representations reveals a comprehensive endeavor focused on improving teacher preparation, honing pedagogical approaches, meeting the needs of early childhood education, and fostering a strong sense of professional community among educators. The conclusions drawn from this analysis have important ramifications for the way educational policies are formulated, curriculum frameworks are created, and programs aimed at improving education standards and strengthening the positions of pedagogical agents are initiated.

5. Discussions

Grounded in the 7C-21 framework, This study delved into influencing factors of preschool teacher's pedagogical ability through an extensive three-decades-long bibliometric analysis of academic research. Over 1100 articles from 300 journals were meticulously examined, showcasing a broad reach, with averages of 14.75 citations per document. Using directive and author-specified keywords, the research reflected diverse linguistic usage across more than 2200 identified keywords. The study highlighted the prevalence of collaborative research, with the presence of close to 2200 authors through various authorship configurations. An international perspective was evident as roughly 10% of the articles represented authors from diverse countries. The comprehensive analysis uncovered key trends in preschool teacher education, helping identify the foremost areas for nurturing pedagogical skills of these educators.

The analysis of data displays a marked upswing in the quantity of academic publications that concentrate on bolstering the abilities of preschool teachers, reflecting their escalating commitment to acquiring fresh pedagogical knowledge (Manning et al., 2017). To tackle the first research question, this evaluation illustrates that scholarly contributions related to preschool teacher competence have shown substantial growth

over the examined thirty-year span. The upward shift in these types of publications signifies a mounting determination within teacher education programs to endorse the professional growth of early childhood teachers. This further highlights the increasing acknowledgment of the pivotal role that preschool teachers serve in the foundational education of young pupils (Manning, et al., 2017). A significant swell in research in this field also accentuates the imperative to elevate the standard of early childhood education programs, as existing research indicates that more thoroughly trained educators are often linked to better outcomes for students (Manning, et al., 2017). Thus, the outcome of this study emphatically points out the potential long-range benefits of higher educational institutions investing in highly qualified preschool teachers and further advancing the professional aspects of early childhood education. This benefits children, their families, and society as a whole.

The examination uncovered a set of principal contributors who have provided significant advancements in the area of preschool teacher proficiency in educational programs, including scholarly publications, authors, countries, and significant documents. Alston-Morgan (2023) elaborated that assessing these critical contributors allows for a deeper understanding of their comprehensive impact within the academic realm. Notably, journals are seen as crucial contributors, steering the dissemination of knowledge throughout the field of preschool teacher competence research. The leading journals serve as prestigious platforms presenting evidence-based teaching methodologies and contemporary views on early educator enhancement. By taking advantage of these prominent journals, researchers and teachers can significantly benefit, keeping them abreast with fresh advancements and actively participating in ongoing academic dialogues. A detailed look at highly productive authors, along with the countries where the research originates, further spotlighted key contributors, emphasizing their shared role in fortifying teacher education on a global scale.

The study shed light on recurrent themes and shifts within academic exchanges around preschool teacher ability in the context of educational programs. As underscored by prior research (Hong, 2010; Hornby, 2011; Lafaele, 2011; Florian, 2009), some notable authors have made specially impactful contributions, aiding in shaping policies, educational methodologies, and the overarching discourse in the sector through their work. The geographic distribution of these significant sources further emphasized the diverse viewpoints on preschool teacher competency and excellent strategies on a global scale. For example, countries like

Finland, Singapore, New Zealand, and Sweden prominently appeared due to their deliberate coordination and investments, resulting in a leading global position in the field of early childhood education. These nations' curriculum designs, initiatives aimed at professional growth, and teaching practices became key references informing efforts of other nations to reinforce the pedagogical abilities of preschool teachers (Hong, 2010; Hornby, 2011; Lafaele, 2011; Florian, 2009). By examining these recurrent themes, trends, and the work of influential authors, a more profound understanding of progress and challenges in preschool teacher education was illuminated. Furthermore, recognizing the strategies and effective practices of leading nations can provide valuable insights and actionable frameworks for countries striving to enhance their preschool education programs. This deeper level analysis bridges the gap between theory and practice, thereby promoting the crucial goal of elevating preschool teacher competence for the ultimate benefit of early childhood education.

This bibliometric study delved into preschool teacher competencies through the perspective of the modern 7C-21 teaching framework. Highlighted was the focus on varied themes like creating instructional expertise in early education and the importance of practical engagement. The research demonstrated a shift towards 7C-21 competencies such as evidence-based practice and creativity, signaling an education system leaning increasingly on scientific backing and innovative teaching models. Keeping abreast of these changes is crucial for preschool teachers. A deeper grasp of these predominant themes could bolster both pre-service teacher education and continuous professional development, thereby potentially enhancing the quality of early childhood education. The insights gained open potential pathways for influencing future policy decisions and development initiatives for educational practitioners.

6. Limitations and prudent recommendations

This study has several limitations that should be acknowledged. The reliance on a single database (Scopus) potentially introduces source bias by excluding important research published in sources not indexed in Scopus. Additionally, restricting the search to English language publications may overlook valuable contributions published in other languages, introducing language bias. Another limitation is the inability to assess the quality and rigor of the included studies. Without a qualitative appraisal of each study's methodology, the findings may be influenced by the strengths and weaknesses of individual studies. The bibliometric approach also does not allow for an in-depth analysis of the contextual factors and complexities influencing preschool teacher competence. A qualitative examination is needed to provide a richer understanding of the nuances in early childhood education. Additionally, the study's focus on publications may overlook valuable insights from the 'grey literature' such as conference presentations, reports, and unpublished studies.

To address these limitations, future research could expand the bibliometric scope by including other databases like ERIC, PsycINFO, and Web of Science to broaden source coverage. Qualitative inquiries exploring the perspectives of educators and policymakers would also complement this quantitative study. Including publications in languages other than English could offer a more globally representative perspective. Additionally, assessing the methodological rigor and contextualizing findings may strengthen conclusions. Ongoing study of preschool teacher competence remains important for evaluating interventions, exploring regional variations, and meeting the evolving needs of early childhood education.

7. Conclusion

This bibliometric study conducted a three-decade analysis of preschool teacher competence in teacher education programs, revealing an upsurge in research aimed at improving preschool teachers' abilities and

emphasizing the need for high-standard early childhood education. The research not only identified key contributors to the field but also offered insights into recurrent themes in academic exchanges, thereby providing an informed perspective on progress and challenges in preschool education. Furthermore, the study underscored the need for aligning preschool teacher competencies with the contemporary 7C-21 teaching framework and the importance of investing in highly qualified preschool teachers. Its findings hold significant implications for stakeholders in preschool education, aiding future policy decisions and developmental initiatives. Recommendations for deeper examination of implications of the thematic clusters and comparative analyses are made for future research. Altogether, the study enriches understanding of preschool teacher competence in teacher education, laying groundwork for further enhancements in preschool education. This implies that future studies should focus on a more detailed exploration of specific thematic clusters and undertake comparative assessments across various regions and timelines to boost comprehension of preschool teacher competence in education.

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CRediT authorship contribution statement

Adane Hailu Herut: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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